<u>REMARKS</u>

Claims 1-29, 31-33, and 45-49 are pending and are rejected. Claims 1, 31, and 45 are amended. Claims 30 and 34-44 were previously withdrawn. Reconsideration and allowance of Claims 1-29, 31-33, and 45-49 are respectfully requested.

<u>Claim Rejections under 35 USC §102</u>

Claims 1-4, 6, and 45-46 are rejected under 35 USC §102(b) as being unpatentable over "A Versatile Data String-Search VLSI," written by Masaki Hirata and published by IEEE in April 1988, (hereinafter referred to as Hirata). Applicant respectfully traverses these rejections.

<u>Independent Claim 1</u>

Applicant's Claim 1, as amended, recites:

A method, comprising:

receiving a text string having a plurality of characters; and

performing an unanchored search of a database of a stored patterns matching one or more characters of the text string using a state machine, wherein the state machine comprises a ternary content addressable memory (TCAM) and wherein the performing comprises comparing a state of the state machine and one of the plurality of characters with contents of a state field and a character field, respectively, stored in the TCAM, wherein the contents of the state field and the character field stored in the TCAM embody state transitions of the state machine.

Hirata fails to disclose or suggest the method of Applicant's Claim 1.

The Office Action again asserts that Hirata discloses "comparing a state and one of the plurality of characters with contents of a state field and a character field, respectively, stored in the TCAM, as the nonanchor search mode, the TCAM and character data stored in the CAM (Hirata: pg. 329, col. 2, lns. 1-12; pg. 330, col. 2, lns. 21-33)." The Office Action also rejects Applicant's previous argument as non-persuasive. Applicant disagrees.

First, in rejecting Applicant's argument that Hirata fails to teach or suggest the feature of "comparing a state and one of the plurality of characters with contents of a state field and a character field, respectively, stored in the TCAM," the Office Action states that Hirata discloses the feature of comparing between states, notes that Hirata is silent about the term "state field" and the term "character field," and concludes that "Hirata inherently discloses the features of state transitions for detecting data string match, which then teaches the state comparisons by comparing each field of characters."

Applicant has amended Claim 1 in an effort to more clearly recite that which the Applicant regards as the invention. More specifically, Claim 1 is amended to recite that "the contents of the state field and the character field stored in the TCAM embody state transitions of the state machine." Support for this clarifying amendment to Claim 1 is provided in Applicant's specification at paragraph [0052],[1] and also in original Claim 23 which recites that the "TCAM includes state information indicative of a state machine."

Applicant notes that Hirata discloses transitioning between various states of a state machine, as is generally known in the art. However, Hirata fails to disclose or teach *using a TCAM device to implement a state machine* "by comparing a state of the state machine and one of the plurality of characters with contents of a state field and a character field, respectively, stored in the TCAM," as recited in Applicant's Claim 1. Thus, Hirata's silence regarding a "state field" stored in the CAM, as acknowledged by the Office Action, clearly indicates that Hirata does not teach using its CAM to implement a state machine.

In contrast to Applicant's Claim 1, Hirata discloses that character strings such as "ABC," "CUSTOM," and "VLSI" are stored in its CAM without state information and

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1   Pargraph [0052] of Applicant's specification states: Figure 3B illustrates one embodiment of fields that can be stored in one or more rows of TCAM cells of search engine 220, and one embodiment of fields that can be stored in one or more rows of memory cells in associated memory 230. In this embodiment, the TCAM fields include a state (STATE) field 351, a pattern character (CHAR) field 352, and the associated memory 230 fields include a next state (NXT_STATE) field 353, an action (ACTION) field 354, and a result (RSLT) field 355. *The state field 351 and the character field 352 together identify a state transition* (emphasis added).

compared with an input string to identify <u>single data string matches.</u>[2] Hirata also

discloses a separate finite-state automaton logic (FSAL) circuit coupled to the CAM

and configured to transition states of its various flip-flops in response to the CAM data

string match results.[3] More specifically, Hirata states that:

> <u>The CAM executes a single data comparison between series input data</u>
> <u>and all the stored data in parallel</u>...When input data and stored data
> match, a single data match signal is generated at the CAM output and
> transmitted to the FSAL. The FSAL is composed of flip-flops and logic
> gates...*The state transition algorithm for strict- or approximate-match*
> *search is executed within the logic gates [of the FSAL]*. The FSAL carries
> out data string sequence comparison, using the single data word
> comparison results from the CAM (emphasis added).[4]

Thus, Hirata's **FSAL circuit implements state transitions of the state**

machine, NOT Hirata's CAM device. Accordingly, in contrast to Applicant's Claim 1,

Hirata's CAM device does NOT store a state field, and does NOT implement a state

machine by comparing a state of the state machine with the contents of the state field

stored in the CAM device. Rather, Hirata specifically states that the **state transition**

algorithm is executed within the logic gates of the FSAL circuit, <u>NOT its CAM</u>

<u>device</u>, as noted above in the quoted portion of Hirata.

Thus, because Hirata fails to disclose or suggest a method comprising

"performing an unanchored search of a database of a stored patterns matching one or

more characters of the text string using a state machine, wherein the state machine

comprises a ternary content addressable memory (TCAM) and wherein the performing

comprises comparing a state of the state machine and one of the plurality of

characters with contents of a state field and a character field, respectively, stored in

the TCAM, wherein the contents of the state field and the character field stored in the

TCAM embody state transitions of the state machine," as recited in Applicant's Claim

1, Claim 1 is patentable over Hirata.

Claims 2-22 depend from Claim 1 and therefore distinguish over Hirata for at

least the same reasons as Claim 1.

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2   See Hirata, page 329, col. 2, lines 19-22; page 330, col. 1, lines 19-21; and Fig. 1.
3   See Hirata, page 330, lines 27-31 and Fig. 2 of Hirata.

Independent Claim 45

Applicant's Claim 45, as amended, recites:

A string search apparatus, comprising:

control circuitry to receive a text string having a plurality of characters; and

a pattern and state database including a ternary content addressable memory (TCAM) coupled to an associated memory, wherein the pattern and state database is operable to perform an unanchored search of the plurality of characters with patterns stored in the TCAM and associated memory by comparing a state of the state machine and one of the plurality of characters with contents of a state field and a character field, respectively, within the patterns stored in the TCAM, wherein the contents of the state field and the character field stored in the TCAM embody state transitions of the state machine.

Note that Applicant has amended Claim 45 to recite that "the contents of the state field and the character field stored in the TCAM embody state transitions of the state machine." Support for this clarifying amendment to Claim 45 is provided in Applicant's specification at paragraph [0052].

As discussed above with respect to Claim 1, Hirata discloses that character strings such as "ABC," "CUSTOM," and "VLSI" are stored in corresponding rows of its CAM device and compared with the text string to identify single data string matches, and further discloses a finite-state automaton logic (FSAL) circuit coupled to the CAM device and configured to transition states in response to CAM data string match results. Thus, in contrast to Applicant's Claim 45, Hirata's CAM device does NOT store a state field, and does NOT implement a state machine by comparing a state of the state machine with the contents of the state field stored in the CAM device. Rather, Hirata specifically states that the state transition algorithm is executed within the logic gates of the FSAL circuit.

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4   Hirata, pg. 330, col. 1, lines 16-31.

Therefore, because Hirata fails to disclose or suggest a string search apparatus including "a pattern and state database including a ternary content addressable memory (TCAM) coupled to an associated memory, wherein the pattern and state database is operable to perform an unanchored search of the plurality of characters with patterns stored in the TCAM and associated memory by comparing a state of the state machine and one of the plurality of characters with contents of a state field and a character field, respectively, within the patterns stored in the TCAM, wherein the contents of the state field and the character field stored in the TCAM embody state transitions of the state machine," as recited in Applicant's Claim 45, Claim 45 is patentable over the cited references.

Claims 46-49 depend from Claim 45 and therefore distinguish over Hirata for at least the same reasons as Claim 45.

Claim Rejections under 35 USC §103 over Hirata in view of Stellenberg

Claims 7-16, 19-21, and 31-33 are rejected as being unpatentable over Hirata in view of U.S. Patent 7,134,143 to Stellenberg et al (Stellenberg). Applicant respectfully traverses these rejections.

Claims 7-16 and 19-21

Claims 7-16 and 19-21 depend from Claim 1 and therefore distinguish over the applied references for at least the same reasons as Claim 1.

Independent Claim 31

Applicant's Claim 31, as amended, recites:

A method, comprising:

receiving a text string having a plurality of characters; and

performing a search of a database of a stored pattern matching one or more characters of the text string using a state machine, wherein the state machine comprises a ternary content addressable memory (TCAM) and wherein the performing comprises comparing a state of the state machine and one of the plurality of

characters with the contents of a state field and a character field, respectively, stored in the TCAM, wherein each of the plurality of characters has a case, wherein the search is performed insensitive to the case, and wherein the contents of the state field and the character field stored in the TCAM embody state transitions of the state machine.

Neither Hirata nor Stellenberg, whether taken alone or in combination, disclose or suggest the method of Applicant's Claim 31.

Note that Applicant has amended Claim 31 to recite that "the contents of the state field and the character field stored in the TCAM embody state transitions of the state machine." Support for this clarifying amendment to Claim 31 is provided in Applicant's specification at paragraph [0052].

As discussed above with respect to Claim 1, Hirata discloses that character strings such as "ABC," "CUSTOM," and "VLSI" are stored in corresponding rows of its CAM device and compared with the text string to identify single data string matches, and further discloses a finite-state automaton logic (FSAL) circuit coupled to the CAM device and configured to transition states in response to CAM data string match results. Thus, in contrast to Applicant's Claim 31, Hirata's CAM device does NOT store a state field, and does NOT implement a state machine by comparing a state of the state machine with the contents of the state field stored in the CAM device. Instead, Hirata specifically states that the state transition algorithm is executed within the logic gates of the FSAL circuit, NOT the CAM device, as discussed above.

Accordingly, because Hirata fails to disclose or suggest "performing a search of a database of a stored pattern matching one or more characters of the text string using a state machine, wherein the state machine comprises a ternary content addressable memory (TCAM) and wherein the performing comprises comparing a state of the state machine and one of the plurality of characters with the contents of a state field and a character field, respectively, stored in the TCAM, wherein each of the plurality of characters has a case, wherein the search is performed insensitive to the case, and wherein the contents of the state field and the character field stored in the TCAM

embody state transitions of the state machine," as recited in Applicant's Claim 31, Claim 31 is patentable over the cited references.

Claims 32-33 depend from Claim 31 and therefore distinguish over the applied references for at least the same reasons as Claim 31.

Claim Rejections under 35 USC §103 over Hirata and Igata

Claims 5 and 49 are rejected as being unpatentable over Hirata in view of U.S. Patent 6,963,942 to Igata (Igata). Applicant respectfully traverses these rejections.

Claim 5 depends from Claim 1 and therefore distinguishes over the applied references for at least the same reasons as Claim 1.

Claim 49 depends from Claim 45 and therefore distinguishes over the applied references for at least the same reasons as Claim 45.

Claim Rejections under 35 USC §103 over Hirata, Stellenberg, and McAuley

Claim 22 is rejected as being unpatentable over Hirata in view of Stellenberg and "Fast Routing Table Look-up using CAMs," written by Anthony J. McAuley and published by IEEE in 1993 (McAuley). Applicant respectfully traverses this rejection.

Claim 22 depends from Claim 1 and therefore distinguishes over the applied references for at least the same reasons as Claim 1.

Claim Rejections under 35 USC §103 over Hirata and Fritchman

Claims 17-18, 23-24, and 28-29 are rejected as being unpatentable over Hirata in view of U.S. Patent 6,785,677 to Fritchman (Fritchman). Applicant respectfully traverses these rejections.

Claims 17-18

Claims 17-18 depend from Claim 1 and therefore distinguish over the applied references for at least the same reasons as Claim 1.

Independent Claim 23

Applicant's Claim 23 recites:

A method, comprising:

receiving a text string having a plurality of characters including a first number of prefix characters, a second number of wildcard characters succeeding the prefix characters, and a third number of suffix characters succeeding the wildcard characters;

performing a first search on a ternary content addressable memory (TCAM) for a first stored pattern matching the prefix characters, wherein the first pattern stored in the TCAM includes state information indicative of a state machine and includes character information indicative of the first pattern; and

performing a second search of the TCAM for a second stored pattern matching the suffix characters, wherein the second pattern stored in the TCAM includes state information indicative of the state machine and includes character information indicative of the second pattern.

Neither Hirata nor Fritchman, whether taken alone or in combination, disclose or suggest the method of Applicant's Claim 23.

As discussed above with respect to Claim 1, Hirata's CAM does NOT store a state field, does NOT compare a state with the contents of the state field stored in the CAM, and does NOT implement a state machine. Rather, Hirata's CAM compares an string to reference data strings stored in the CAM, and outputs match signals for single data string matches that are used by an FSAL circuit formed by flip-flops to transition states. Thus, Hirata's CAM does NOT store state information indicative of a state machine, as recited in Applicant's Claim 23.

Accordingly, because Hirata nor Fritchman, whether taken alone or in combination, disclose or suggest "performing a first search on a ternary content addressable memory (TCAM) for a first stored pattern matching the prefix characters, *wherein the first pattern stored in the TCAM includes state information indicative of a state machine* and includes character information indicative of the first pattern

(emphasis added)," as recited in Applicant's Claim 23, Claim 23 is patentable over the cited references.

Claims 24-29 depend from Claim 23 and therefore distinguish over the applied references for at least the same reasons as Claim 23.

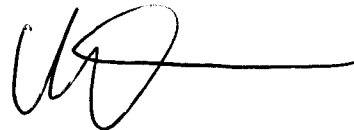Claim Rejections under 35 USC §103 over Hirata and other references

Claims 47-48 are rejected as being unpatentable over Hirata in view of various other applied references. Applicant respectfully traverses these rejections.

Claims 47-48 depend from Claim 45 and therefore distinguish over the applied references for at least the same reasons as Claim 45.

CONCLUSION

In light of the above remarks, it is believed that Claims 1-29, 31-33, and 45-49 are allowable, and therefore a Notice of Allowance of Claims 1-29, 31-33, and 45-49 is respectfully requested. If the Examiner's next action is other than allowance as requested, the Examiner is requested to call the undersigned at (408) 236-6646.

Respectfully submitted,

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